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been used by me and has proved very satisfactory.

In a foot-cylinder with a ground top is placed a smaller graduated cylinder containing the solution. The larger cylinder contains sufficient solvent to reach nearly to the top of the smaller one. The system is enclosed by a ground-glass vaselined plate covering the outer cylinder. Gradually the volume of the solution increases and the change in volume can be accurately followed and recorded.

In an experiment which lasted two months the total change in a nearly saturated salt solution was from 5.8 c.c. to 6.6 c.c., or nearly 14 per cent. This is to be repeated for verification, and other solutions of various solvents and solutes studied.

JAMES H. RANSOM

PURDUE UNIVERSITY,
March 25, 1916

SCIENTIFIC BOOKS

Engineering as a Career. A series of papers by eminent engineers, edited by F. H. NEWELL and C. E. DRAYER.

This book of 214 pages is made up of selections from the writings of different engineers so chosen as to embrace a broad field of practice. It is a mosaic presenting attractive fragments from the work of active leaders in steel-making, in manufacturing, in marine engineering, in railroad operation and maintenance, in municipal administration, in industrial management, in architecture, in mining and metallurgical work, and in other equally interesting and important lines of activity. The book opens with a general discussion of the engineer and his profession by Mr. Albert J. Himes. Mr. Worcester R. Warner speaks especially from the standpoint of the mechanical engineer, Mr. A. W. Johnston from that of the railway engineer, and Mr. Chester W. Larner from that of the hydraulic engineer. Altogether twenty-two selections are presented. They make an impressive picture drawn by men of experience, concerning the opportunities offered to and the attributes of character required by one who seeks a career as an engineer.

The book will interest parents, ambitious for the success of their growing sons, who are approaching the question as to whether their sons shall go to college, and if so, whether they shall seek to become engineers; it will interest multitudes of high-school boys, who are wavering between the call of business and that of the technical or professional school; and it will interest engineers who enjoy any well-considered formulated statement which seeks to set forth broad views of the engineer's problem and of the place which he must assume in society. But it is especially for the boy and for the parents of boys.

The editing has been a labor of love, the work having been done by Mr. C. E. Drayer, secretary and later president of the Cleveland Engineering Society, and by Professor F. H. Newell, head of the department of civil engineering of the University of Illinois, who for twenty-five years served the government in an engineering capacity, principally as chief engineer and later as director of the United States Reclamation Service which has been responsible for the building of great reservoirs and irrigation canals throughout the arid west.

W. F. M. Goss

UNIVERSITY OF ILLINOIS

The Rare Earths. By S. I. LEVY, B.A. (Cantab.), B.Sc. (Lond.), A.I.C., Late Hutchinson Research Student of St. John's College, Cambridge. Longmans, Green and Company. With illustrations. Pp. 359. Net, \$3.00.

This is the first book published in English that attempts to give a fairly comprehensive account of the rare-earth group, and the magnitude of the task has resulted in a volume of considerable size.

An introduction written by Sir William Crookes, himself a master in this field of research, does much at the outset to give the book standing.

The work is divided into three parts: I. Occurrence of the Rare Earths; II. Chemistry of the Elements; III. Technology of the Elements. The author has included zirconium and titanium among the elements treated, because of their occurrence in rare-earth min-

erals. Just why columbium and tantalum do not find a place here for the same reason is not altogether clear; but of course a limit had to be set.

Part I. classifies the minerals as follows: (1) silicates; (2) titano-silicates and titanates; (3) tantalo-columbates; (4) oxides and carbonates; and (5) phosphates and halides. Such a classification of the one hundred and fifty or more rare-earth minerals, giving the percentages of the chief rare earths present, is useful and has already been adopted by other authors. A valuable addition to this list is the giving of the locality where the minerals are found.

Part II. discusses adequately and satisfactorily, on the whole, the chemistry of the elements. A fair amount of attention is given to the separation processes so many and complicated in this group. The spectroscopic methods, absorption, spark, arc and cathode luminescence, methods themselves of the highest value, are duly emphasized, and Urbain's recent application of magnetic susceptibility receives its proper consideration. It is of interest to note that the lanthanum test consisting of a blue color when iodine is brought into contact with the hydroxide find a place in the book, although no one of whom the reviewer knows has been successful in applying it.

Part III. is concerned mainly with an account of the development of the incandescent light industry. This is a most instructive history, and deserves all the space assigned to it, as it has given the main impetus to rare-earth investigation during the past thirty years.

A feature which commends the book is its international scope. American, English, French and German chemists will find their work fairly represented.

The book is an important contribution to inorganic chemistry, and should be in the library of every inorganic chemist for study or at least for reference.

PHILIP E. BROWNING

Relativity and the Electron Theory. By E. CUNNINGHAM. Longmans, Green and Company, London. Pp. vii + 96.

The author has a large work on this subject printed by the Cambridge University Press and now presents a short monograph, from which the more difficult mathematical work is omitted. The result is a book which may be read without serious effort, even by persons not specialists in the theory of relativity or in mathematical physics. The titles of the chapter are: I. Introductory; II. The Origin of the Principle; III. The Relativity of Space and Time; IV. The Relativity of the Electro-magnetic Vectors; V. Mechanics and the Principle of Relativity; VI. Minkowski's Four-Dimension Vectors; VII. The New Mechanics; VIII. Relativity and an Objective *Æther*. Throughout the work emphasis is laid upon the physical foundations of relativity and upon its physical consequences. Something is also said of the philosophical meaning of relativity.

The natural book with which to compare Cunningham's is Carmichael's Monograph, "The Theory of Relativity," published by John Wiley and Sons. The essential element of contrast is that Carmichael proceeds in the Euclidean fashion from definite assumptions or postulates to definite theorems; whereas Cunningham writes in the ordinary style of the physicist. The one lays greater stress on logical foundation, the other upon the physical connections of the theory. So different is the point of view that even though the results overlap to a large extent, any reader of one of the monographs would find much additional interest in reading the other. The change in the concepts of mass and time and space which is suggested by the theory of relativity is so perplexing to many persons that the reading of both these texts will be none too much to allay their anxieties. The mathematician should begin with Carmichael and the physicist with Cunningham.

EDWIN BIDWELL WILSON

SPECIAL ARTICLES

THE RELATION OF OSMOTIC PRESSURE AND IMBIBITION IN THE LIVING MUSCLE

1. A SERIES of independent observations by Nasse, the writer, Overton, Meigs, Beutner,